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IBM Technical Disclosure
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(58) Field of search
B6F
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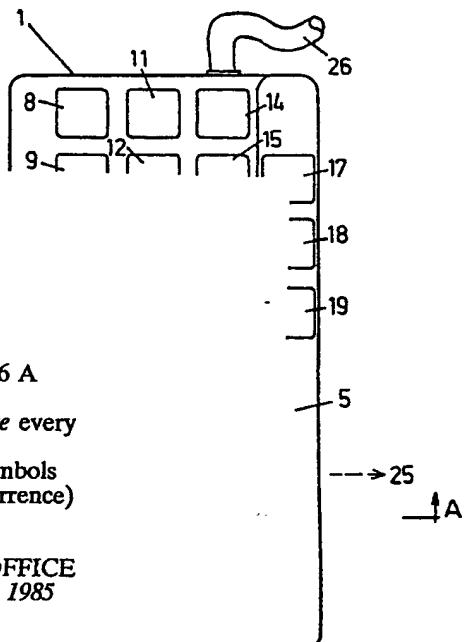
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(54) Keyboards

(57) The input device comprises a keypad 1 that is manually movable between a central position (as shown), a leftwards position 24, and a rightwards position 25 to select and enable groups of legends 4 that are on displayed on a CRT, or a similar display device, such that actuation of a key associated with one of the

legends enabled will generate signals indicative of the particular symbol actuated. The device may be associated with a base 2 incorporating the display 3 and the keypad itself. The input device can be quite compact, yet permits users to "type" rapidly with ease because of the use of the movable keypad to reduce substantial hand movement. And because the legends are electronically displayed they can be brought under program control thus allowing users the option to define their own characters sets, or special key designations.

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THE PATENT OFFICE
19th December, 1985

GB 2 131 746 A

FIG. 1

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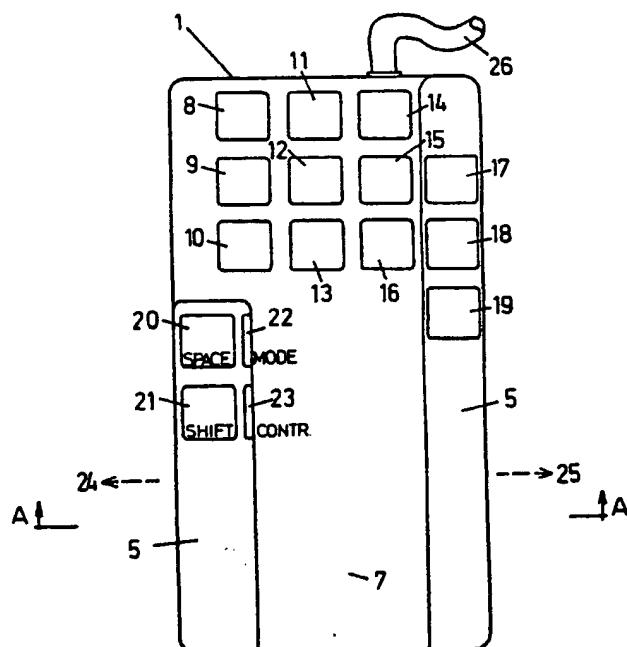


Fig. 1

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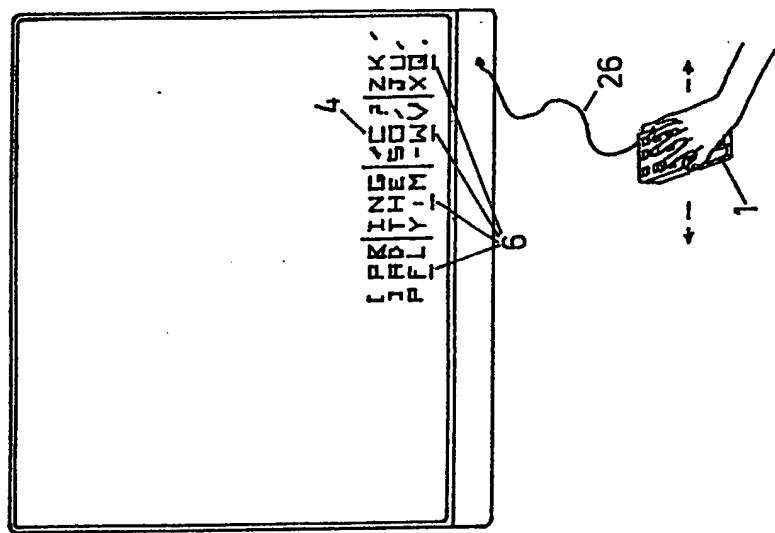


Fig. 2

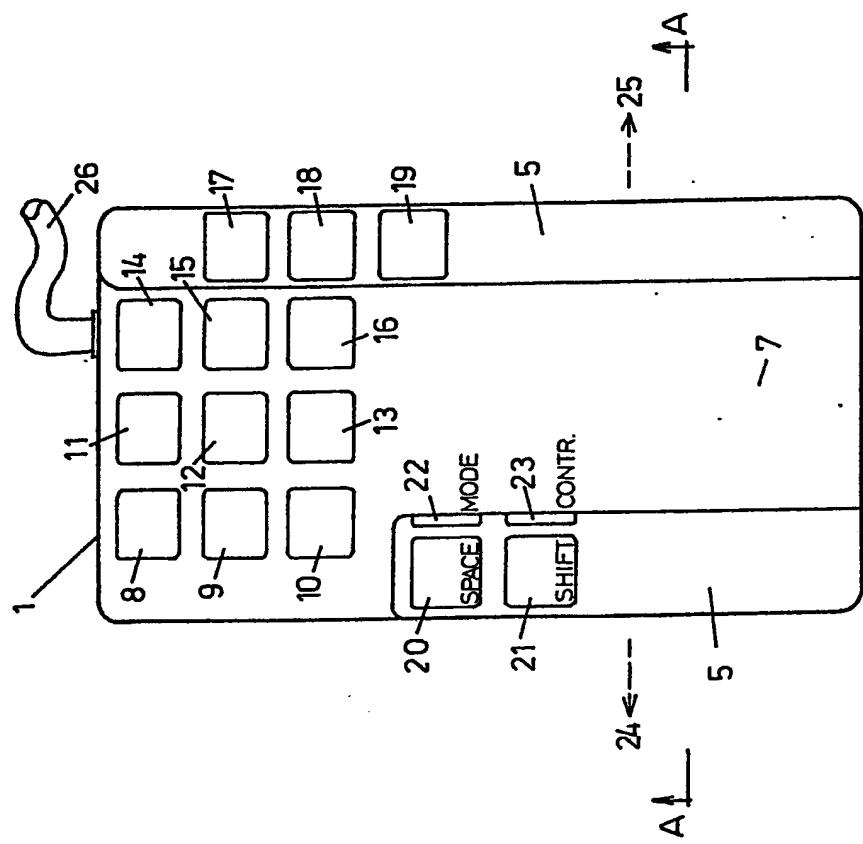


Fig. 1

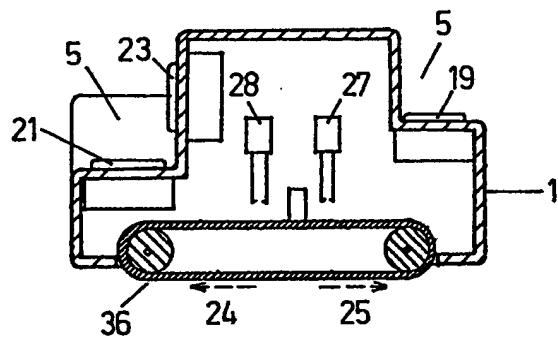


Fig. 4

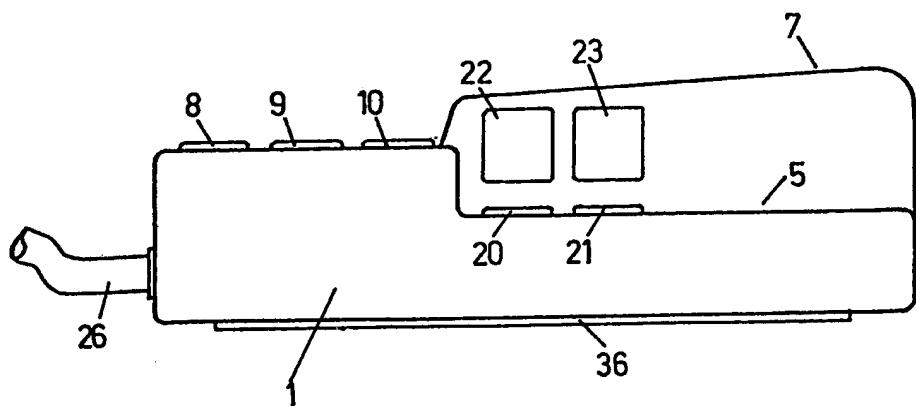


Fig. 3

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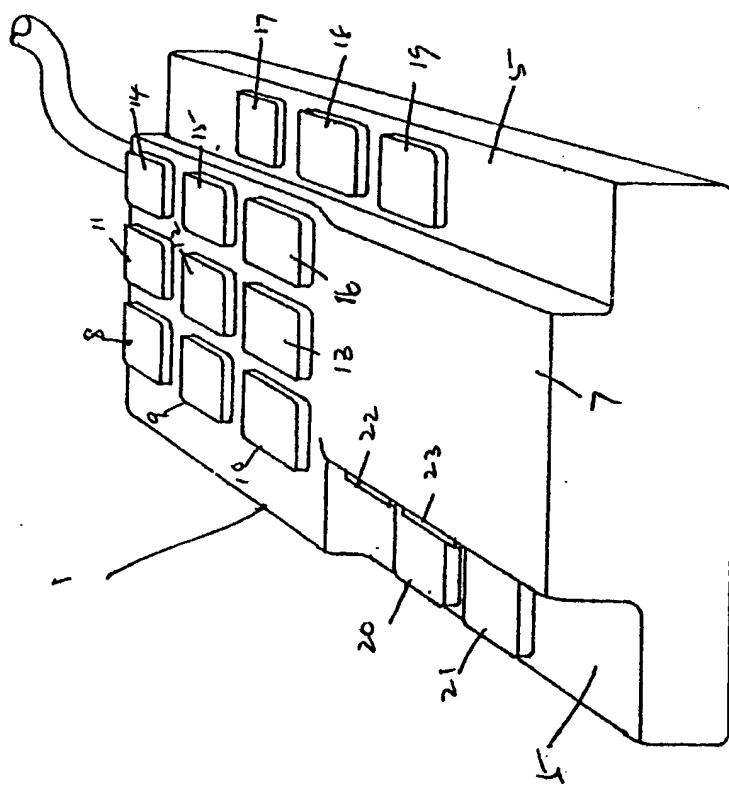


FIG. 5

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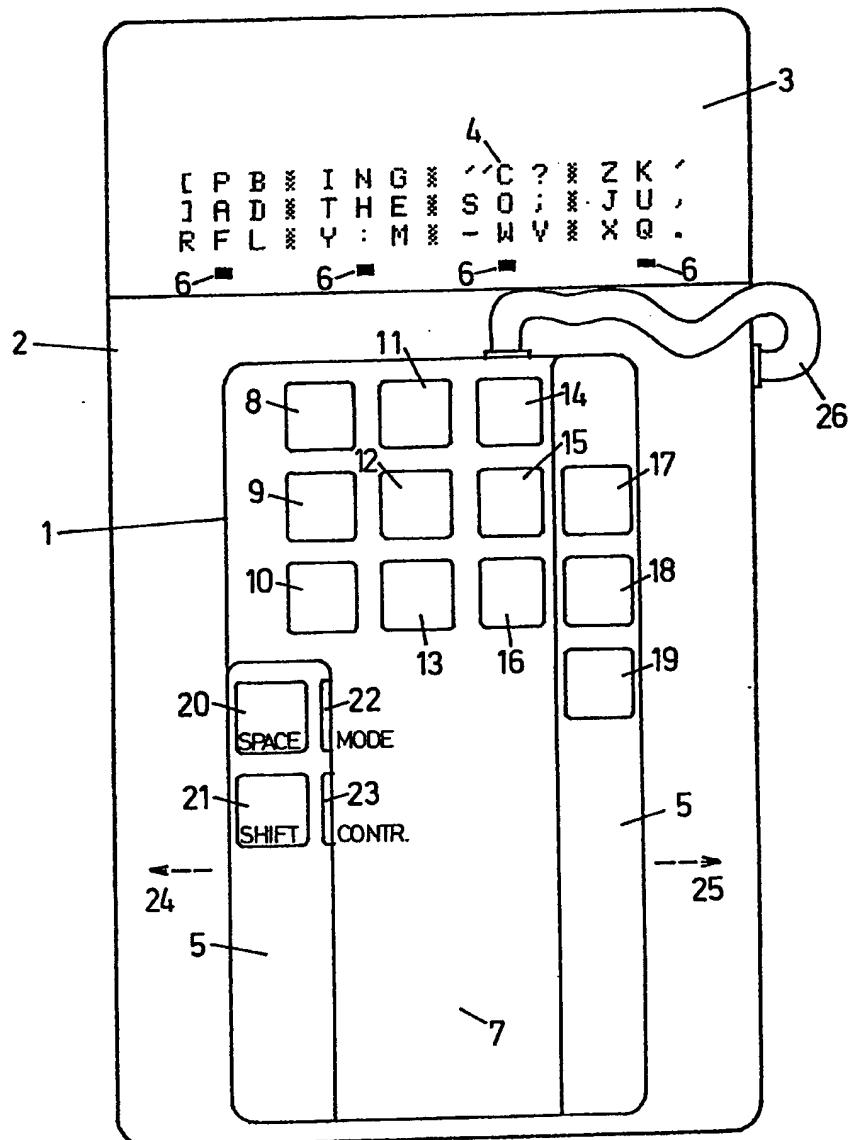


Fig. 6

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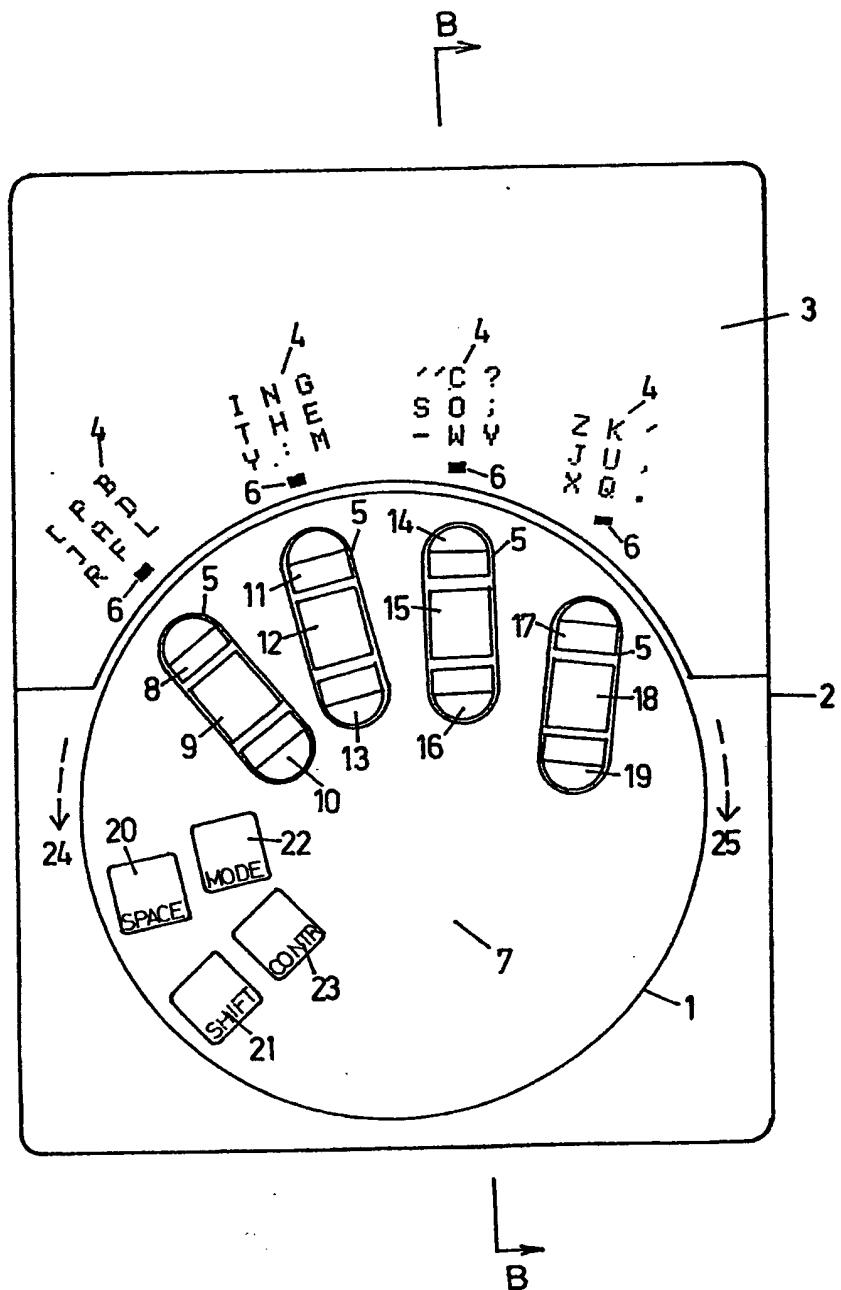


Fig. 7

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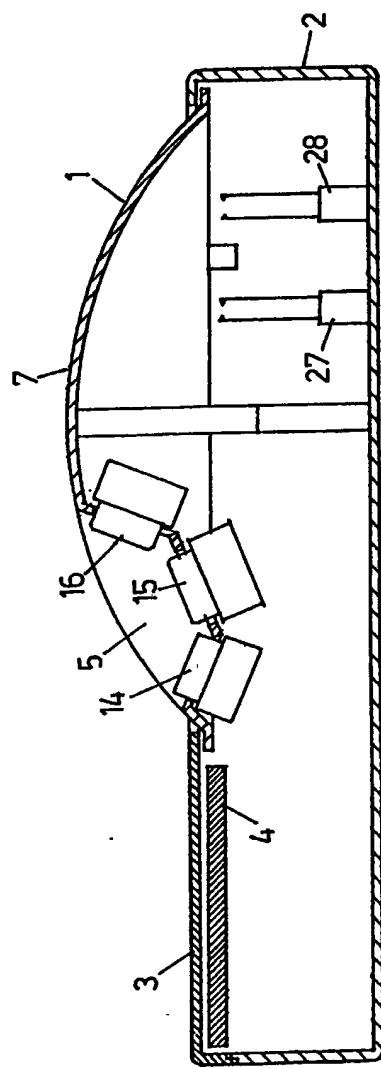


Fig. 8

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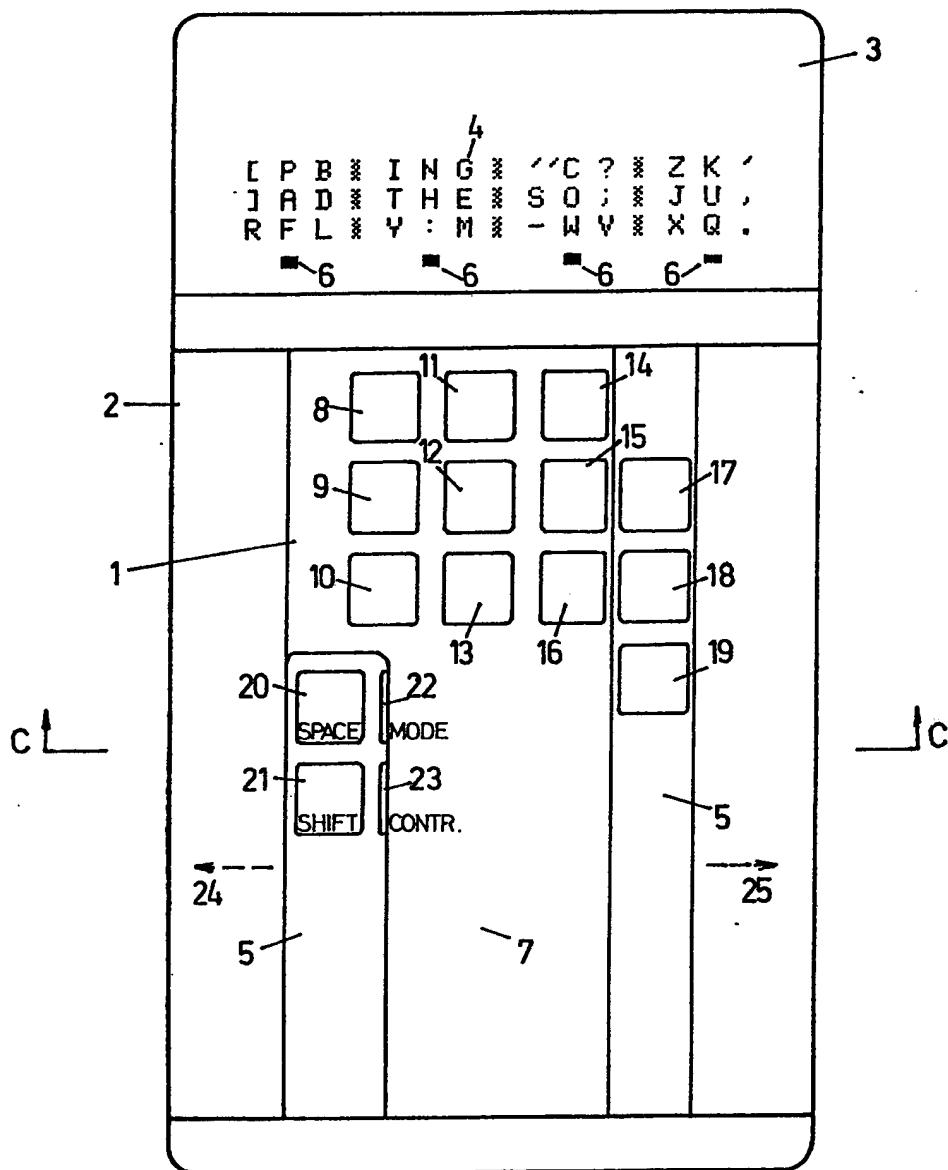


Fig. 9

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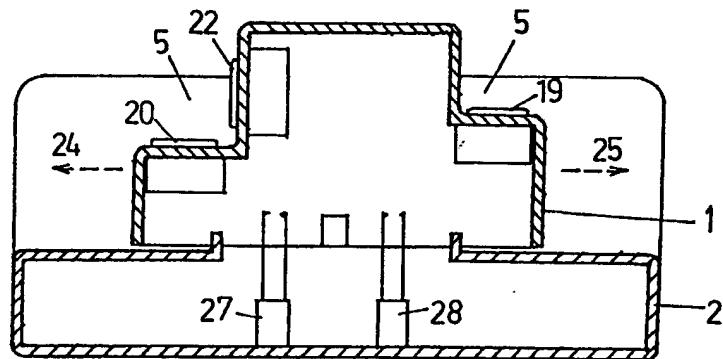


Fig.10

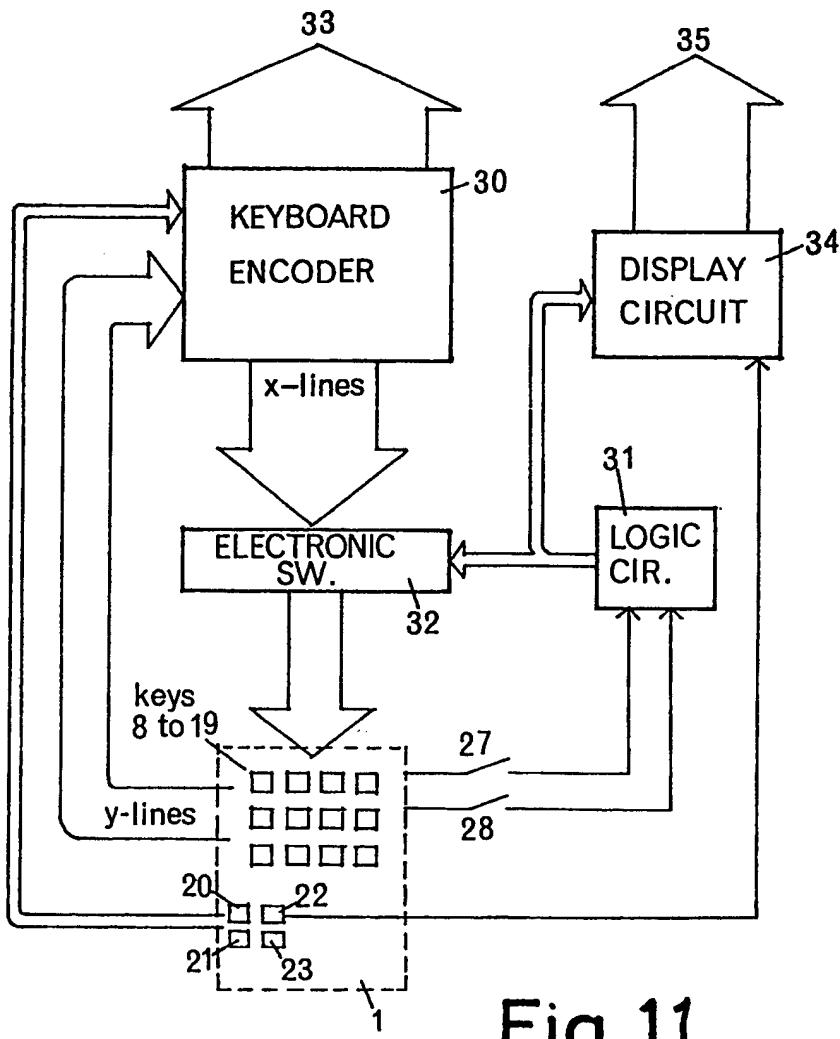


Fig.11

SPECIFICATION**Input device for entering of units of information**

The invention relates to a single-hand operated device for entering of units of information,

5 encoded as electrical signals, that are suitable for a light emitting display, printer, data transmission device, computer, or other similar devices that would otherwise require some form of keyboard to enter the information.

10 Up until now such keyboards have been in the form of the conventional Qwerty keyboard. However, as the trend towards miniaturization continues, with machines getting smaller and moving out of their stationary roles into roles of 15 portables, it becomes every important to have an input device which is small, and at the same time provides easy and efficient use, to replace the bulky conventional keyboard.

Small keyboards are available in the market, and 20 based upon the situation of the existing art we see two broad approaches that have been taken to provide portability. In one such approach, the device is based on the conventional Qwerty, though considerably reduced in dimension to 25 make it portable. However, because it has tended towards a similar key-configuration as the Qwerty, the keys have to be positioned close together, therefore making such a device easy to mis-key, and also impossible to use at any speed.

30 A second approach involves the use of the chording operation, whereby characters or symbols are created by using the keys in various combination referred to as chords. Operation of such a device is slow and difficult because the 35 finger movements are not intuitive, and it is easy to make errors since most characters, or symbols, require more than one key to be depressed simultaneously.

Both of the abovementioned devices, while 40 compact, suffer from the simple drawback that they are difficult to use and, therefore, have not been well suited to the majority of users. In practical terms, these devices are fine for keying in, or retrieving, small amount of data but very limiting 45 and demanding both in time and effort for a user needing to input and/or to retrieve larger amount of data.

The invention has therefore been made with 50 these points in mind and it is the object of the present invention to provide an input device that is compact, efficient, and convenient to use.

According to the invention in a first aspect there is provided an input device for the entering of units of information, including characters, 55 symbols, functions, and/or musical notes (hereinafter collectively referred to as "symbols"), encoded as electrical signals that are suitable for a light emitting display, printer, data transmission device, computer, or other such keyboard

60 operated device, comprising a keypad carrying a plurality of keys, the said keypad being designed to be manually operable by a sliding movement of the said keypad on a surface in order to activate switch devices and thereby electronically select

65 and enable groups of legends representing the symbols of the respective keys that are displayed on a CRT, or similar display devices, in use with the said keypad, through a plurality of indicating means, such that actuation of a key associated 70 with one of the said legends displayed within the group referenced by the said indicating means, will cause electronics means to generate signals indicative of the particular symbol corresponding to the actuated key and position of the said 75 keypad selected, said display of legends are grouped and configured in such a way as to be associated with the key configuration, direction of movement, and operational positions of the said keypad, keys being arranged in a pattern providing 80 groups of keys, the keys of each group being positioned for actuation selectively by a single human digit.

It is preferable that the said switch device associated with the sliding movement of the 85 keypad be an integral part of the keypad. In this connection, the said keypad is provided with a slidably mounted lower surface that is movable by sliding the keypad on a surface and thus activate said switch devices. The sliding movement

90 referred to is preferable to be confined between a rest position and a further two possible positions that are to the left and right of the rest position, and is so arranged that movement in the one direction will activate a first of said switch devices, 95 and movement in the other direction, while deactivating the first switch device, will activate a second of the said switch devices with an intermediate position in which both of the above-mentioned switch devices are inactive, thereby

100 providing a logical indication of which of the three operational positions the keypad is in. According to the one of the said three positions selected, electronics means will then generate signals to identify, through a set of indicating means, and 105 enable the desired column of legends displayed on a CRT, or other similar display device, for accessment by the respective finger keys. To ensure that the said keypad will return to its rest position when released, the said lower surface of

110 the keypad may be resiliently loaded towards its rest position. This added resilience will help the user to determine from its feel which position the keypad is in. This will lessen the likelihood of error, and speed up operation particularly when touch typing.

In order for the user to associate each key with the legends on display, the display format of the indicating means and the legends representing the symbols of the respective keys should preferably 120 take into account factors relating to the directional movement, operational positions, and key configurations of the keypad. In a preferred arrangement, the said keypad on being switched on will transmit the appropriate signals to have on display on a CRT, or similar display device, that is in use with the input device, the said indicating means and the said legends of the respective keys which are arranged in a format providing groups of legends, the number of groups being equivalent in 125

- number to the number of column of finger keys provided for on the said keypad, each said group of legends are further arranged in columns, corresponding to the operational positions of the keypad, and in rows for the rows to be related to the positions of the finger keys that are arranged beneath each respective finger. For each operational positions available to the said keypad there is provided for each said group of legends a single indicating means positioned so as to identify each respective column of legend that is enabled for accessment by the respective finger keys.
- Preferably, the keys of the said keypad are to be conveniently laid out so that each digit has arranged beneath it, in columns corresponding to the position of each of the digits of one hand, a number of keys designed for the use of that digit, comprising within each column at least three or more keys positioned to be reached by movement of the digit forward and backward relative to the body of the user. Because of its high mobility, the thumb is, preferably to be provided with more than one column of keys. To allow for the length of the longer fingers the keys for these fingers may be set deeper into the keypad in the form of a scoop.
- As the input device according to the invention is designed in its operation to be slid about, hand/keypad contact should be maximised to provide sufficient "purchase" for the hand to move the keypad comfortably. In a preferred arrangement, appropriately positioned troughs and palm ridge are provided for on the keypad.
- Also according to the invention there is provided a method of generating units of information including characters, symbols, functions and/or musical notes (hereinafter collectively called "symbols"), in which keys of a keypad are actuated by the touch of human digits on the keys, individually or in conjunction with a sliding movement of the said keypad on a surface by the human hand, to select through indicative means groups of legends representing the symbols of the respective keys displayed on a CRT, or like devices, whereby electrical and/or electronics means translating these keypad movements and said key actuation to provide signals representing the symbol actuated.
- There will now be set out a number of features of the invention in accordance with a second aspect of the invention.
- According to the present invention in a second aspect there is provided an input device for the entering of units of information, including characters, symbols, functions, and/or musical notes (hereinafter collectively called "symbols"), encoded as electrical signals that are suitable for a light emitting display, printer, data transmission device, computer, or other such keyboard operated device, comprising a base and a keypad carrying a plurality of keys, the said keypad being designed to be manually operable by a sliding movement of the said keypad on a surface provided for by the said base in order to activate switch devices that are integral to the said base,

- and thereby electronically select and enable groups of legends representing the symbols of the respective keys displayed in the form of LCD, or similar devices, that are located on the said base, through a plurality of indicating means such that actuation of a key associated with one of the legends displayed within the group referenced by the said indicating means, will cause electronics means to generate signals indicative of the particular symbol corresponding to the actuated key and position of the said keypad selected, said display of legends are grouped and configured in such a way as to be associated with the key configuration, direction of movement, and operational positions of the said keypad, keys being arranged in a pattern providing groups of keys, the keys of each group being positioned for operation selectively by a single human digit.
- The said base, preferably, carries a compact display device, such as LCD, on which to present to the user the legends of the respective keys and the symbol which has been generated.
- The invention in the second aspect find particular application in devices where portability is desired such as in pocket computers, pocket electronic books, electronic musical instruments, etc.
- It is to be appreciated that the various features set out in accordance with the two aspects of the invention may equally well be applicable in combination with each other. In particular, there may be provided an input device as set out in accordance with the second aspect of the invention in which the said keypad is provided with a slidably mounted lower surface, as set out in accordance with the first aspect of the invention, to activate switch devices that are integral to the keypad, in which case the said base may be provided with appropriate socket/s to interface with the said keypad through external flexible link/s.
- The invention may be carried into practice in various ways and embodiments will now be described by way of example with reference to the accompanying drawings in which:
- Figure 1 is a plan view of a preferred input device embodying the invention, suitable for right-handed use;
- Figure 2 is a view of the input device, as shown in figure 1 in use with a CRT;
- Figure 3 is a left view of the input device shown in figure 1;
- Figure 4 is a cross-sectional view taken through figure 1 along line A—A, looking in the direction of the arrows;
- Figure 5 is a perspective view of the input device shown in figure 1;
- Figure 6 is a plan view of a version of the input device shown in figure 1 incorporating a base;
- Figure 7 is an alternative input device embodying the invention, and illustrates a version with a circular keypad;
- Figure 8 is a cross-sectional view taken through figure 7 along line B—B, looking in the direction of the arrows;

Figure 9 is a further alternative input device embodying the invention, and illustrates a version having integral to its base, switch devices that are used for the logical indication of the operational positions of the keypad;

Figure 10 is a cross-sectional view taken through figure 9 along line C—C, looking in the direction of the arrows, and

Figure 11 is block diagram showing one embodiment of the electronics used in an input device according to the invention.

Referring to figure 1 to 10, the invention comprises a movable keypad 1, and may also incorporate a base 2 as shown in figures 6 to 10, with the keypad 1 having 1 set of non-symbol formings keys (20 to 23) for the user by the thumb, and 4 columns of symbol-forming finger keys (8 to 19) which are arranged for the use of the index, middle, ring, and little fingers of one human hand. Keys 9, 12, 15, and 18 are the 'home'-keys on which these fingers rest, and all keys are depressed by the respective fingers in the downward motion. Finger recesses 5 and palm ridge 7 are there to facilitate the side to side or rotatory movement of the keypad 1.

Said keypad 1 is slidable between a first position 24 and a second position 25 to close switch devices 27 and 28 respectively. When released, keypad 1 returns by a spring (not shown) to its rest position, in which case said switch devices 27 and 28 are opened. The particular conditions, closed or opened, of the said devices (27, 28) provide a logical indication of which of the three operational positions in which keypad 1 is situated, and according to the one of the said three operational positions selected, electronic means will then generate signals to enable the desired column of legends displayed (4). Indicating means 6 'follows' the movement of the keypad 1 to provide a visual reference as to the position of the keypad 1 and thereby indicating the particular columns of legends displayed (4) that are enabled for selection by corresponding keys.

Legends 4 is arranged in four groups of nine, configured in such a way for the groups to be associated with the four respective columns of finger keys (8 to 19). Each of the four groups of legends (4) are further arranged in horizontal rows, the distribution of which corresponds to the positions of the finger keys (8 to 19) that are arranged beneath each respective finger, and in 3 columns corresponding to the three operational positions of the keypad 1. At any one time only one set of these four groups of nine legends (4) and indicating means (6) are on display, with one set of legends representing the principal symbols on permanent display when the device is first switched on, and a secondary set of legends representing less used symbols coming on only when the mode key 22 is depressed.

The base 2 provides a surface on which the keypad 1 moves, and a see-through surface 3 through which a display device, such as LCD, showing legends (4) of the respective keys,

indicating means (6), and the symbol which has been generated appear through.

In use, the selection of a specific symbol is first made by moving the keypad 1 to one of the three operational positions to enable a particular column of the legends through indicating means 6 according to prior reference to the display 4. The specific symbol signals are then generated by depressing the appropriate key. For example, to signify character B, D, or L keypad 1 is moved to the right 25 thereby also moving indicating means 6 to the BDL column as well as other corresponding columns of legends 4. The depression of keys 8, 9, or 10 will signify B, D, or L respectively. Likewise character R, T, or Z is made accessible to the respective keys by moving keypad 1 to the left 24 followed by the depression of keys 10, 12, or 17 respectively, while characters in the middle columns are accessible to the respective keys 85. when keypad 1 is at rest.

Therefore, specific characters are signified by actuation of one key with keypad 1 at rest, or in combination with switch device 27 or 28 at position 24 or 25 of keypad 1. At no time when 90 signifying a single character is more than one finger key depressed simultaneously.

Referring to fig. 11, this illustrates the general schematic arrangement of the electronics of the input device which are standard electronics such 95 as are commonly used in keyboards, and the requirements will be apparent to those skilled in the art of electronics.

The keys of the keypad 1 (fig. 1) are arranged into a matrix with the X lines from the keyboard 100 encoder circuit 30 outputting test pulses in time sequence and the Y lines sensing their presence. If no key is depressed, the keyboard encoder circuit 30 continuously scans the keys. Whenever a key is depressed, the scanning action stops and that 105 location, referred to as an address, is held by the internal circuitry of the encoder 30. The address is routed to an internal ROM. In exchange for an address and information on the status of the shift and control keys the ROM give the proper output 110 code at 33. The logic circuit 31 controls electronics switches 32 that switch over the X lines of the keys to make with the appropriate X lines from the encoder board 30 in accordance to the condition of switch devices 27 and 28. The 115 same signals from the logic circuit 31 is also routed to a display circuit 34 to control the display of the indicating means together with the display of the legends of the device.

An input device according to the invention can 120 be quite compact without sacrificing any human-factor requirements. Despite its size a large number of symbols can be generated. This is possible because instead of relying on the conventional method of 'typing' in which the 125 fingers hop from one key top to another for actuation, the keypad is designed, utilizing electronics to replace these finger movement by groups of indicating means, and all that remains for the hand of the user to do is to guide the 130 movement of these indicating means by simple

- left-right movements of the keypad, with the majority of fingers at all time remaining in their 'home' positions. This ability of the input device to move the indicating means from one column to another column of legends by a sliding movement also means that words or frequently used combinations of letters, e.g. 'the', 'he', 'ing', etc. can be produced, depending on the layout of the legends, in a single rapid movement, and if the legends are to be brought under program control, any given symbol can then be displayed and signified, thus allowing users the option to define their own character sets, or special key designations.

15 CLAIMS

1. An input device for the entering of units of information, including characters, symbols, and/or functions (hereinafter collectively referred to as symbols), encoded as electrical signals that are suitable for a light emitting display, printer, data transmission device, computer, or other such keyboard operated device, comprising a keypad carrying a plurality of keys, the said keypad being designed to be manually movable in order to activate switch devices and thereby electronically select and enable groups of legends representing the symbols of the respective keys that are displayed on a CRT, or a similar display device, that is in use with the said keypad, such that actuation of a key associated with one of the said legends within the group that are so enabled will cause electronics means to generate signals indicative of the particular symbol corresponding to the actuated key and position of the keypad selected.
2. An input device as claimed in Claim 1, in which the said keypad movement is movement consisting of substantially sliding movement.
3. An input device as claimed in Claim 1 or Claim 2, in which the said movement of the keypad are confined between a rest position and a further two possible positions that are to the left and right of the said rest position and so arranged that the movement will actuate the said switch devices that are to electronically enable the legends.
4. An input device as claimed in any preceding claim, in which the keypad is provided with a slidably mounted lower surface to actuate said switch devices.
5. An input device as claimed in claim 4, in which the said slidably mounted lower surface is resiliently loaded towards its rest position.
6. An input device as claimed in any preceding claim, in which the said keypad includes the said switch devices which are positioned to be actuated by the movement of the keypad.
7. An input device as claimed in any preceding claim incorporating a base which serves to provide a surface on which the keypad can move.
8. An input device as claimed in Claim 1 to Claim 5 incorporating a base which serves to locate the keypad in such a way as to permit the keypad to move to actuate the said switch devices

- 65 that are provided for within the base itself.
9. An input device as claimed in Claim 7 or Claim 8, in which the base incorporates a visual display to show the legends of the respective keys available on the keypad.
- 70 10. An input device as claimed in any preceding claim, in which there is included on the display a plurality of indicating means for the said legends positioned so as to identify the groups of legends that are enabled for accessment by the corresponding keys.
- 75 11. An input device as claimed in any preceding claim, in which the display also includes means of showing the symbol generated.
12. An input device as claimed in any preceding 80 claim, in which the display of legends and their corresponding indicating means are grouped and configured in such a way as to be associated with the key configuration, direction of movement, and the operational positions of the keypad.
- 85 13. An input device as claimed in any preceding claim, in which the legends on displayed are arranged in a format providing groups of legends, the number of groups being equivalent in number to the number of columns of finger keys provided for on the keypad, with each said group of legends being further arranged in columns corresponding to the operational positions of the keypad, and in rows for the rows to be related to the positions of the finger keys that are arranged beneath each respective finger.
- 90 14. An input device as claimed in any preceding claim, in which there is provided for each column of legends a single indicating mean and so arranged that only those indicating means that are related to the columns of legends that are enabled by the position of the keypad selected for accessment by corresponding keys are on display at any one time.
- 100 15. An input device as claimed in any preceding claim, in which the display of legends and indicating means is under program control so as to provide the mean to define different character sets, and/or special key designations.
- 110 16. An input device as claimed in any preceding claim, in which the configuration of the keys are related to the format of the legends on displayed.
- 115 17. An input device as claimed in any preceding claim, in which the keys are laid out so that each digit has arranged beneath it in groups, a number of keys designed for the use of that digit.
- 120 18. An input device as claimed in Claim 17, in which each said group of keys comprises at least one column of three or more keys positioned to allow keys of the column to be reached by movement of a digit forward and backward relative to the body of the user.
- 125 19. A method of generating units of information including characters, symbols, and/or functions (hereinafter collectively called "symbols"), in which keys of a keypad are actuated by the touch of human digits on the keys, individually or in conjunction with a manual movement of the said keypad on a surface to select through a plurality of indicative means groups of legends representing

- the symbols of the respective keys displayed on a CRT, or a similar device, whereby electrical and/or electronics means translating the keypad movement and key actuation to provide signals representing the symbol actuated.
- 5 20. A method as claimed in Claim 19, in which the said keypad movement consisting of substantially sliding movement.
- 10 21. A method as claimed in Claim 19 or Claim 20, in which the said movement of the keypad are confined between a rest position and a further two possible positions that are to the left and right of the said rest position and so arranged that the movement will actuate the said switch devices
- 15 that are to electronically enable the legends.
- 20 22. A method as claimed in Claim 19 to Claim 21, in which there is included on the display a plurality of indicating means for the said legends positioned so as to identify the groups of legends
- 25 that are enabled for accessment by the corresponding keys.
23. A method as claimed in Claim 19 to Claim 22, in which the display of legends and their corresponding indicating means are grouped and configured in such a way as to be associated with the key configuration, direction of movement, and the operational positions of the keypad.
24. A method as claimed in Claim 19 to Claim 23, in which the legends on displayed are
- 30 arranged in a format providing groups of legends, the number of groups being equivalent in number to the number of columns of finger keys provided for on the keypad, with each said group of legends being further arranged in columns corresponding
- 35 to the operational positions of the keypad, and in rows for the rows to be related to the positions of the finger keys that are arranged beneath each respective finger.
25. A method as claimed in Claim 19 or Claim 40 24, in which there is provided for each column of legends a single indicating mean and so arranged that only those indicating mean that are related to the columns of legends that are enabled by the
- 45 position of the keypad selected for accessment by corresponding keys are on display at any one time.
26. A method as claimed in Claim 19 to Claim 50 25, in which the display of legends and indicating means is under program control so as to provide the mean to define different character sets, and/or special key designations.
27. A method as claimed in Claim 19 to Claim 26, in which the configuration of the keys are related to the format of the legends on displayed.
28. An input device constructed and arranged 55 substantially as herein described with reference to and as shown in figures 1, 2, 3, 4 and 10, of the accompanying drawings.
29. An input device constructed and arranged substantially as herein described with reference to 60 and shown in figures 5 and 10, of the accompanying drawings.
30. An input device constructed and arranged substantially as herein described with reference to and shown in figures 6, 7 and 10, of the 65 accompanying drawings.
31. An input device constructed and arranged substantially as herein described with reference to and shown in figures 8, 9 and 10, of the accompanying drawings.
- 70 32. A method of operating an input device constructed and arranged substantially as herein described with reference to and shown in figures 1, 2, 3, 4 and 10, of the accompanying drawings.
33. A method of operating an input device 75 constructed and arranged substantially as herein described with reference to and shown in figures 5 and 10, of the accompanying drawings.
34. A method of operating an input device 80 constructed and arranged substantially as herein described with reference to and shown in figures 6, 7 and 10 of the accompanying drawings.
35. A method of operating an input device 85 constructed and arranged substantially as herein described with reference to and shown in figures 8, 9 and 10 of the accompanying drawings.